

Environmental Health

Design Standards for Large On-Site Sewage Systems

With Design Flows of Greater Than
3,500 Gallons Per Day

December 1993
(Amended July 1994)



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Section 1

Introduction

The technical design and procedural requirements for obtaining approval of large on-site sewage systems (handling more than 3,500 gallons of domestic sewage per day) are noted in Chapter 246-272 WAC. Additional or more stringent requirements may be noted in the regulations, ordinances, and policies of appropriate local jurisdictions. These design standards were developed to amend and revise the state of Washington's Department of Ecology (Ecology) and Department of Health (DOH) Design Guidelines for Larger On-site Sewage Systems (December 1979 and 1987). The requirements of the Design Standards are adopted by reference in DOH Chapter 246-272 WAC.

Review Agencies

- A. The Department of Ecology (Ecology) is responsible for reviewing and approving the following on-site systems:
 - 1. Domestic or Industrial wastewater under Chapter 173-240 WAC.
 - 2. Sewage systems using a mechanical treatment system or lagoons with ultimate design flows above 3,500 gallons/day.
 - 3. Any system utilizing subsurface disposal which has received a federal or state construction grant administered by Ecology.
- B. The Department of Health (DOH) is responsible for reviewing and approving domestic on-site systems utilizing subsurface soil disposal with ultimate design flows through any common point between 3,500 and 14,500 gallons/day excluding those types of systems for which Ecology is responsible.

DOH Plan Review Fees

The minimum fee for required review and approval activities of large on-site systems is established under Chapter 246-272 WAC. Fees shall be billed to project proponents through invoice when all review and approval activities are completed or at times determined by the review agency.

Intra-Agency Coordination

The review and approval agency will notify the appropriate local health department/district (LHD) of a proposed large on-site system. If requested, a copy of the engineering report and plans and specifications will be sent to the LHD. The LHD will make comments to the appropriate review agency. More restrictive requirements in local regulations as noted by LHD's shall prevail.

LOSS Operating Permits

In accordance with Chapter 246-272 WAC, all Large On-site Sewage Systems (LOSS) approved by DOH or LHD shall obtain a LOSS Operating Permit. New large systems approved by DOH shall be issued a permit after the department receives the required construction report, as-built plans and the operation and maintenance manual. Annual reports as outlined in Section 4, shall be submitted to DOH to retain compliance with LOSS Operating Permit conditions.

Section 2

Pre-Design

A. Pre-design Document

1. Prior to the preparation of an engineering report and plans and specifications, a pre-design document should be submitted by the project proponent. This should be followed by a pre-design meeting. The primary focus of this procedure is to determine the conceptual feasibility of the project, identify the reviewing agency, and note any special requirements. The pre-design document does not have to be prepared by a qualified engineer and final design details are not needed.
2. The following information should be included in the pre-design document:
 - a. Name, phone, and address of applicant(s)
 - b. Name, phone, and address of designer, engineer, etc., (if known)
 - c. Name, phone, and address of any other contact person, legal owners, site address, tax parcel number.
 - d. Narrative: The narrative should be a brief explanation of the project or concept. It should indicate the nature of the project, type of facilities to be served, and other relevant information (such as phased development, time frames, etc.)
 - e. Physical description of site: The document should provide the legal description of the site. It should address site conditions, soils and any limiting features. Soil information may be limited to SCS reports or independent soils investigations. Test pits are optional at this point (must be provided for the engineering report). An estimated loading rate, if known, should be assigned. A map should also be provided, noting as much of the site information as is available. This does not need to be a detailed, surveyed, topographic map, but should be adequate in scale and exactness to reveal the basic information.
 - f. Water Supply: A statement of intent regarding the water supply is necessary.
 - g. Disposal concept: This should address the total anticipated wastewater flows, desired design features, any planned phased development, unique conditions or other relative information. The proposed management entity for providing on-going operation and maintenance should be indicated.

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- h. Treatment concept: This should address how the sewage is to be treated and adequately disposed of without adverse effects on the environment.

B. Pre-design Meeting

Using the information presented in the pre-design document, a pre-design meeting should be held between the applicant and the appropriate review and approval agencies. The result of the pre-design meeting will be a clear understanding of review agency requirements, fees, and special design considerations. Experience has shown that a pre-design meeting can save a proposed project time and money.

Engineering Reports

A. General Information

1. All new or expanding on-site systems shall have an engineering report prepared by a qualified professional engineer, (P.E.). The report shall outline the scope of the proposed construction and include an analysis of the disposal area's capability to adequately treat and dispose of the proposed sewage quantities from the project. The report should also contain those items noted in "Large on-site systems" and "Developments, subdivisions, and minimum land area requirements" under Chapter 246-272 WAC and in Section 5 of these Design Standards.
2. Three (3) copies of the final report, stamped and signed by a P.E., shall be submitted to the appropriate review agency for approval. If desired, a draft report, may be submitted first for comment. The report, whether draft or final, must be complete when it is submitted, containing all the required information.
3. The engineering report may be submitted concurrently with the plans and specifications.
4. Review agency staff shall make site inspections to determine whether they concur with the submitted site and soil analysis. Concurrent site inspections by the proponent's soils expert and the review agency may be scheduled to assist in completing the report and determining appropriate loading rates.

B. Report Contents

All engineering reports shall contain, but not be limited to, the following:

1. General Information
 - a. Owner's name, address, and phone number
 - b. Engineer's name, address, and phone number
 - c. Project description, site address, tax parcel number
 - d. Project location

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- e. Description of any existing system including design criteria
 - f. Source of domestic water
 - g. Activity or land use of area - present and anticipated
2. Maps
- a. A detailed area map - This should show the entire proposed development, adjacent areas, and all acreage under development.
 - b. A development plan - This should be a map of the area to scale. It should include the total development, not just the disposal area. This map should show the following:
 - (1) The area designated for both the primary and reserve drainfields, as well as other treatment and disposal system components.
 - (2) Any surface waters or wells within 1,000 feet of the disposal area.
 - (3) Structures, roads, and parking areas adjacent to the proposed disposal area.
 - (4) Any on-site stormwater systems, retention basins, or drainage areas for the projects.
 - (5) Contour lines should be drawn on ten foot intervals. Contours for slopes more than 10 percent should be verified by field measurements.
 - (6) All water lines and sewer lines within 1,000 feet.
 - (7) Location of 10-year, 25-year and 100-year flood boundaries, if applicable. Location of scouring channel of stream or river.
 - (8) Drainage basins and drainage patterns throughout the development site.
 - (9) Any classified wetland within a 1000 feet of the drainfield area.
3. Geology - This should be a discussion of the geology and its relationship to the existing ground water and soil conditions.
4. Ground water
- a. Depth to ground water
 - b. If an unconfined aquifer exists that is usable for potable purposes, then water quality information on the aquifer should be obtained, if not already available.
 - c. Direction of flow in the aquifer, if known.

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- d. Locations, capacities, and well logs, if available, for all wells and springs within 1,000 feet. (Copies of well logs may be available at the appropriate regional office of the Department of Ecology.)
 - e. If the location of the drainfield is within an area of special concern as outlined with Chapter 246-272 WAC, a statement of compliance with any special design or site requirements.
5. Soils
- a. The soils should be analyzed by a qualified P.E. or soil scientist (American Registry of Certified Professionals in Agronomy - Crops and Soils) as well as review agency personnel. Joint inspection of soil logs should be performed when possible.
 - b. Pits need to be dug to develop soil logs.
 - (1) The desired number will vary depending on the uniformity of soils on the site. At a minimum there shall be one pit in the center of each drainfield system (each 50%).
 - (2) Pits should be dug in both the proposed primary and reserve drainfield areas.
 - (3) The pits should follow a grid pattern over the proposed areas.
 - (4) Pits should be dug below final drainfield elevation and to a depth of at least six feet or to groundwater (preferably 10 feet). They should be dug by a backhoe. The excavation shall be prepared as noted in "Soil and Site Evaluation" in Chapter 246-272 WAC.
 - (5) At a minimum, samples of soil shall be collected for a particle size analysis (sieve and hydrometer analysis) from soil logs located in each drainfield area. The samples should be representative of the soils at the level of the anticipated bottom of the trenches/bed.
 - (6) The standard methods to be used for performing these analyses shall conform to ASTM C 136, Method for Sieve Analysis of Fine and Coarse Aggregates, ASTM E 11, Specification for Wire-Cloth Sieves for Testing Purposes, ASTM C 117, Methods for Materials Finer than .0075 mm (No. 200) Sieve in Mineral Aggregates by Washing, and ASTM D 422, Method for Particle Size Analysis of Soils.
 - c. Soil logs should be developed for each pit describing the soils in accordance with the terminology and procedures noted in Chapter 3 and Appendix A of Design Manual: On-site Wastewater Treatment and Disposal Systems, U.S. EPA (Reference 7).
6. Location
- a. The maximum slope on which drainfield construction is allowed shall be 30 percent (17°).
 - b. There shall be a minimum vertical separation of three feet between the bottom of all portions of the trench or bed and any restrictive layer or water table. The use of alternative systems such as mounds may not be used to achieve the required separation.

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- c. Setbacks shall be as noted in Chapter 246-272 WAC.

7. Design Criteria

- a. The engineering report shall provide the basis which will be utilized in developing the final plans and specifications. The facility should be designed in accordance with the Design Standards and Chapter 246-272 WAC. Justification for any deviation from the Design Standards shall also be included in the engineering report. Most of the detail will be in the plans and specifications, but some criteria are necessary in the engineering report. Other design references such as References 1, 2, 7, 8 and 10 should be considered.
- b. The criteria should include, but not be limited to:

- (1) Hydraulic loading rate - The loading rate is dependent upon the most restrictive soil texture noted within 3' below the proposed bottom of the trench or bed. Section 5, Table 2 notes the maximum loading rates in gallons per day per square foot that must be used for sizing the system. These rates shall apply to bottom area only. The loading rates mentioned on Section 5 Table 2 are suitable for effluent with BOD₅ of 230 mg/liter or less, Suspended Solids ratio of 150 mg/l or less and Total Oil and Grease (G&O) of < 50 mg/l which is similar to the maximum range of domestic sewage. If the facility has BOD₅, TSS or G&O of greater strength effluent than domestic sewage, then the effluent should be: 1) pre-treated to reduce the BOD₅; 2) the loading rate may be reduced so that the BOD₅ loading per unit area per unit time remains constant. This option is only available to BOD₅ of < 500 mg/l and on a case by case basis by the review agency. (Example: A loading rate for a BOD₅ of 460 mg/L in medium sand would be 0.5 GPD/SQ-FT.)
- (2) All pre-treatment methods shall meet the appropriate State technical Review Committee (TRC) guidelines for high strength waste or be listed as an approved proprietary device on the DOH list.

- 8. Type 1A soils and areas of special concern - As defined by Chapter 246-272 WAC. Designs shall at minimum meet the land area and other requirements outlined in Chapter 246-272 WAC and any more stringent local regulation.

- a. If the trench/bed will be installed in Type 1A soils (see page 21, Table 2), a minimum of two feet of coarse sand (See Fill Specifications, Section 5, page 25) shall be placed below the absorption field lateral and 6 to 12 inches to the sides of the trench as per the DOH "Guidelines for Sand Filters" (Reference 11). The size of the system shall be determined by using the loading rate for a coarse sand found in Section 5 "Design Criteria".

- 9. Input Balance - It is generally required for areas with high rainfall and shallow and/or slowly permeable soils but may be required at any time by the review agency. The measurements should be made for the most limiting time of the year. (Greatest Net Precipitation) The intent of the input balance is a determination of the capacity of the soil in the drainfield area to accept and transmit all the effluent and to remain in unsaturated condition. As a minimum, the input balance shall include:

- a. Estimation of all inputs (effluent, inflow, precipitation and infiltration)

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- b. Estimation of all outputs (evapotranspiration, horizontal and vertical conductivity, gradient)
 - c. The output shall be greater than the input.
- 10. A nitrate balance may be required in areas where the quantities, qualities, and direction of ground water flow are known.
- 11. Minimum Land Area
 - a. As per Chapter 246-272 WAC.
 - b. If the disposal field is located in a different area with variable soil conditions, the minimum land area shall be based on the predominant soil texture in the drainfield area.
 - c. A reduction in flows due to the use of reduced water flow devices may not be used in reducing the minimum land area outlined in Chapter 246-272 WAC.
- 12. Compliance with Other Local and State Regulations.
 - a. SEPA Compliance - This shall show that the total project, not just the on-site system, has received approval under SEPA. Approval may be shown by:
 - (1) a signed declaration of nonsignificance from the local agency with jurisdiction; or
 - (2) a letter from the agency with jurisdiction stating that the final EIS is acceptable, or
 - (3) a letter from the local agency with jurisdiction stating the total development is exempt from SEPA.
 - b. If all or part of a project is in a shorelines area, a statement that the total project is in conformance with shoreline master plans, coastal zone management plans, and flood control zone requirements shall be included in the engineering report.
 - c. The project shall comply with any local zoning, platting, and building requirements as they relate to sewer utilities.
- 13. Schedule for Phase Development
- 14. Operation and Maintenance Consideration - Discuss the options available for management of the system. Explain the preferred option.

Section 3

Plans and Specifications

A. Submittal/Review

1. The person proposing the system shall have complete plans and specifications prepared, stamped and signed by a P.E.. The plans and specifications shall be in conformance with the approved engineering report, if not submitted concurrently.
2. Three (3) copies of the final plans and specifications should be submit for approval to the appropriate review agency. If desired, a draft set of plans and specifications may be submitted first for comment. The plans specifications, whether draft or final, should be complete when it submitted, containing all the detail and information required.

B. Plans

1. Design criteria and calculations should be submitted with plans.
2. A schematic flow diagram should be provided.
3. The location, dimensions, and elevations of all treatment and pumping units should be given.
4. Plans should cover (both plan and profile views, where applicable).
 - a. sewer lines - sizes, materials, etc.
 - b. pump stations - capacity, materials, etc.
 - c. septic tanks - size, materials, baffling, liquid volume, scum and sludge volumes
 - d. drainfield - detail on width, depth and length, pipe sizes and materials, configuration, etc. This should be to a scale of 1:50 or better (1 = 50 feet or less) with contours in the drainfield area to be on two foot intervals.
 - e. alarm systems
 - f. flow metering
5. Plans should include the proposed provisions for inspection of the work during construction by the design engineer. This shall include pre-testing of the pressure distribution network which will be conducted or witnessed by the design engineer. DOH shall also witness the testing of the distribution network. A minimum of five working days notice shall be given to DOH to schedule inspection. A check list of recommended inspections is included in Appendix 2.

C. Specifications

1. Objective - The objective is to supplement the plans by describing the intended project in sufficient detail for construction by a builder.
2. Contents - Specifications shall be in conformance with nationally recognized standards, including but not limited to APWA, Ten States Standards and Criteria for Sewage Works, Washington State, Department of Ecology, Washington State Department of Transportation (WSDOT). The specifications should include, but not be limited to, all construction information which is not shown on the drawings and is necessary to inform the builder in detail of the design requirements as to:
 - a. the quality of materials;
 - b. workmanship and fabrication of the project;
 - c. the type, size, strength, operating characteristics, and rating of equipment;
 - d. allowable leakage of joints, including machinery, valves, piping, and jointing of pipe;
 - e. electrical apparatus, wiring;
 - f. the meters;
 - g. operating tools;
 - h. construction materials;
 - i. special filter materials such as gravel;
 - j. miscellaneous appurtenances;
 - k. instructions for testing materials and equipment as necessary to meet design standards; and
 - l. operating tests for the completed works and component units.

Construction Inspections

- A. The installation shall be made by a contractor certified as an installer by the Local Health Department having jurisdiction over the area in which the project is located.
- B. The appropriate review agency must be notified for inspections as agreed upon prior to completion of system segments.
- C. Inspections during construction must be conducted by the design engineer or authorized representative as per the approved inspection schedule included the plans. Special inspections shall be made by the design engineer or an authorized representative during system construction for the following type of work:

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1. Poured in place septic tanks/pump chambers or other special containment vessels.
 2. Alternative system or shallow drainfield installation
 3. Placement of select fill material or final elevation of fill or special excavation requirements.
- D. Any substantial deviations from the approved engineering report or plans and specifications must be submitted to the review agency for approval prior making the change.
- E. A detailed construction plan is advised. It may be required in areas of limited access, tight soils, high rainfall, or for any difficult construction area.
- F. Within 60 days following the completion of and prior to the use of any portion of the project for which approval has been obtained, a construction report is to be submitted to the approval agency by the P.E. who submitted the plans specifications.
1. Systems approved by DOH require an engineer's construction report and shall be submitted to DOH on a form provided by the department along with "as built" drawings if changes from the approved plans and specifications occurred during construction, as per Chapter 246-272 WAC.

Section 4

Operation and Maintenance Manuals

- A. **Introduction** - The type and size of a large on-site system dictate what operation and maintenance (O&M) activities are necessary. This is a general outline of items to be considered for inclusion in an O&M manual. A draft manual may be submitted along with the plans and specifications for a specific project. The final O&M manual shall be stamped, signed and dated by a P.E. and shall be submitted with the "as-built" drawings and the construction report.
- B. The manual should include, but not be limited to, schedules and/or procedures for the following items:
1. Response to emergencies. Emergency procedures should include provisions for:
 - a. Notifying the users, the approval agency and the LHD of the emergency.
 - b. Determining the cause of any failure or malfunction. The findings should be submitted in written form to the review and approval agency.
 - c. Making repairs, replacements, or modifications of design as required to restore functioning of system.
 2. Periodic inspection of facilities to ascertain efficiency of operation and general condition of equipment - checklists.

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3. Periodic pumping of septic tanks, pump or siphon chambers or other storage tanks by licensed septic tank pumpers or periodic pumping/maintenance of other pretreatment mechanisms by appropriate qualified personnel. Copies of any pumping contracts should be included.
 4. Periodic maintenance of pumps, motors, and switches.
 5. Replacement or repair of worn or damaged equipment.
 6. Monitoring of water usage/wastewater generation.
 7. Dosing/resting cycles for the drainfields.
 8. Determining water levels - in trenches and/or ground water.
 9. Monitoring of groundwater or adjacent surface water quality, if deemed necessary.
 10. Other appropriate helpful activities depending on type of system.
 11. Sample forms for all O&M activities.
- C. Records should be kept of all inspections, monitoring, work done, conditions found, etc. The records should be available for inspection by the approval agency any time. Annually, summary reports of the system maintenance and operation shall be sent to DOH in accordance with the requirements for a LOSS Operating Permit in Chapter 246-272 WAC.
- D. If O&M is by a municipality or other public entity operating many systems, a general manual with additional requirements for specific systems may be appropriate.
- E. A sample operation and maintenance manual is included within Appendix 1 of this document. It should be noted that all operation and maintenance manuals are system specific and the example should only be used as a guide for the minimum required information.

Management Entity

- A. For systems approved by DOH, management shall be provided by an entity approved by the department as follows:
1. For single family and/or multi-family subdivisions where the parcels/lots are individually owned - A public entity (municipal corporation) shall serve as either the primary management entity or as the third party trust, if management is performed by a private entity.
 2. For all other uses, including single ownership, commercial, etc. - A public entity or a private entity via an appropriate contract or agreement shall provide management.
 3. Additional agreements may be required by DOH to ensure proper management and oversight of any entity approved for a large on-site system.

Section 5

Design Flow Data

- A. The flows in Tables 1-A and 1-B should be used. The reference section may be of assistance concerning flows from sources not noted in tables. If it is felt that peak flows are greater than those given in the table or references, the peak flows should be used. This may occur when infiltration is not considered or when readings are long term averages, e.g. monthly or weekly averages.
- B. Deviations from the above flows may be considered for non-residential development. Justification from such deviations may include flows measurements from similar comparable facilities, developments, or uses. A minimum of three similar establishments or developments shall be used to compare design flows. Average flow data shall take into account peaking factors.

Note: Those LHD jurisdictions that will coordinate reviews with DOH may require design flows of 150 GPD/bedroom. For those LHD jurisdictions, please adjust Table I-A accordingly.

Table 1-A
Design Flows for Single or Multi-family
Dwellings and Mobile Home Parks
(Based on 120 gallons/bedroom/day) (Reference 8)

Bedrooms Per Dwelling Unit	Individuals Per Dwelling Unit (Estimated)	Flow per Dwelling Unit (gal/day) *
1	2	200
2	3	240
3	3.5	360
4	4.5	480

* Minimum design flow per unit.

Note: Subdivisions and new mobile home parks shall use 360 gpd/lot or space as minimum design flow.

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Table 1-B.
Design Flows for Facilities Other than Residential Development (Reference 8)

Discharge Facility	Design Units	Flow** (gpd)	Duration (hr)
Schools with showers and cafeteria	per person	16	8
Schools without showers and with cafeteria	per person	12.6	8
Schools without showers and without cafeteria	per pers	10	8
Boarding schools	per person	75	16
Motels at 65 gal/person (rooms only)	per room	130	24
Restaurants*	per seat	50	16
Interstate or through highway restaurants*	per seat	180	16
Interstate rest areas	per person	5	24
Service stations	per vehicle served	10	16
Factories (showers)	per person per 8-hr shift	25	Operating Period
Factories (no showers)	per person per 8-hr shift	15	"
Shopping centers*	per 1,000 sq ft of ultimate floor space	200-300	12
Hospitals*	per bed	300	24
Nursing homes*	per bed	200	24
Homes for the aged*	per bed	100	24
Doctor's office in medical center*	per 1,000 ft	500	12
Laundromats	per machine	500	16
Community colleges	per student and faculty	15	12
Swimming pools	per swimmer	10	12
Theaters, drive-in type	per car	5	4
Theaters, auditorium type	per seat	5	12
Churches (no kitchen)	per seat	3	4
Churches (with kitchens)	per seat	5	4
Day Care Centers	per person	20	12
Picnic areas	per person	5	12
Campgrounds, with limited comfort stations No laundry, no wet sewer hookup,	per camp site	50	24
Campgrounds/RV parks, with flush toilets, showers, laundry, no wet sewer hookup	per camp site	75	24
Campgrounds/RV Parks, with flush toilets, showers, with or without laundry facilities and wet sewer hookup	per camp site	100	24
Campgrounds/RV Parks with wet sewer hookup only, no comfort station	per camp site	50	24
Trailer Dump Stations*	per dump	20	24

* Indicates potential high waste strengths facilities requiring pre-treatment

** Includes normal infiltration

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Disposal Field Design Standards

- A. **Pressure distribution is required.** The system shall be designed to comply with the "Guidelines for the Use of Pressure Distribution Systems" (Reference 4).
- B. All portions of the bottom and side-walls of the gravel-filled disposal trench/bed shall be located in original undisturbed soil, the only exception is when using fill material in type 1A soils. Fill may be used as cover over the top of the trench/bed (6-24 inches). The maximum depth from final grade to the bottom of the trench or bed shall be 36 inches. Soil loading rates shall be as indicated in Table 2, page 21 Maximum Loading Rates for Various Soils for Domestic Sewage.
- C. The required drainfield area shall be split into two 50 percent drainfields. A third 50 percent shall be constructed initially in order to provide for alternation (long term resting) and repair capability. Alternation shall be performed as per the "Guidelines for Alternating and Dosing Systems" (Reference 5). See Figure 1. As noted in Figure 1, a reserve area equal to an additional 50 percent where conditions are suitable for drainfield installation is required. Where facilities have automatic resting cycles built into the application, (for example, campgrounds), this requirement for three 50 percent drainfields and alternation may not be necessary. A 100 percent reserve area meeting all location requirements shall be required where the third 50 percent field requirement is waived.
- D. Absorption beds (trenches greater than 3 ft. wide) are only allowed in soils with a texture of Type 1A, 1B, 2A or 2B soils for larger systems. Absorption beds shall be designed to be long and narrow to reduce unit area loading. Maximum absorption bed width shall be 10 feet. Dimensions and spacing between beds shall be determined by evaluating the hydraulic conductivity of the soil and the ability of the absorption bed to remain in unsaturated condition and to transmit the liquid satisfactorily into the environment. Minimum spacing shall be 20 feet from the edge of one absorption bed to the next absorption bed to facilitate proper aerobic conditions. Absorption beds may not be allowed in certain critical ground water areas. Please contact the approving agency as to the appropriateness of designing these systems in your area.
- E. Barrier material covering the gravel trench or bed shall be as follows:
The geotextile shall be non-woven, and meet or exceed the following "Minimum Average Roll Values." The fabric shall be free of any chemical treatment or coating which reduces permeability and shall be inert to chemicals commonly found in soil.

Property	Test Procedure	Unit	Minimum Value
Grab Strength	ASTM D4632	Lbs	60
Puncture Tear	ASTM D4833	Lbs	18
Trapezoid Tear	ASTM D4533	Lbs	25
Flow Rate	ASTM D4491	Gal/ft ² /min	100
Apparent Opening	ASTM D4751	U.S. Std. Sieve ¹	
Size (AOS)			

¹ Soil with 50% or less particles by weight passing U.S. No. 200 sieve, AOS less than 0.6 mm (greater than #30 U.S. Std. sieve). Soil with more than 50% particles by weight passing U.S. No. 200 sieve, AOS less than 0.297 mm (greater than #50 U.S. Std. sieve).

- F. Monitoring ports are required and shall be located at a minimum at the center and ends of each 50% absorption bed. Monitoring ports shall be installed at a minimum at each corner of a 50% drainfield (See Figure 1)
- G. Where trenches are used, the minimum separation between trenches shall be 4.5 feet of undisturbed soil. In those cases where trenches are installed in sand and gravel soils or on slopes, additional space between trenches may be required. Minimum spacing shall be 15 feet from the edge of one 50% drainfield to the next 50% drainfield, when trenches are used.
- H. The bottoms of all trenches or absorption beds shall be constructed level. The installer or design engineer shall assure proper construction practices are used (i.e. lasers, construction levels or transits) to complete trenches or beds in conformance with approved plans and specifications. If select fill is used for a Type 1A soil condition, then the trench or bed excavation and final fill elevation shall be level and as per DOH "Guidelines for Sand Filters" (Reference 11).
- I. The drainfield aggregate below and above the drainfield laterals shall be 3/4 to 1-1/2 inches in diameter preferably (up to 2 inches in diameter may be acceptable), clean, washed, non-deteriorating gravel, meeting at least the Washington State Department of Transportation (WSDOT) Standards for Course Aggregate for Portland Cement, with the additional requirement that the percent by weight passing the U.S. No. 200 sieve shall not be greater than 0.5 percent. Other types of drainfield aggregate may be accepted on a case by case basis using the WSDOT standard as a guide (Reference 10). Gravelless drainfield systems may also be used in lieu of aggregate but only in accordance with TRC Guidelines for Gravelless Drainfield Systems (Reference 13).
- J. Waivers - Deviation from the Design Standards requires a waiver as per Chapter 246-272 WAC. Procedures to apply for a waiver can be obtained from the review agency.

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Loading Rates

Table 2.
Maximum Loading Rates for Various Soils
for Domestic Sewage (Reference Chapter 246-272 WAC)

Soil Type	Soil Textural Classification	Loading Rate gal/day/ft²
1A	Very gravelly ¹ Coarse Sands or Coarser All extremely gravelly soils ²	Unsuitable
1B	Very gravelly medium sand, very gravelly fine sand, very gravelly very fine sand, very gravelly loamy sands	Varies according to non-gravel soil type
2A	Coarse sands(including ASTM C-33)	1.2
2B	Medium Sands	1.0
3	Fine Sands, Loamy coarse sands loamy medium sands	.8
4	Very fine sands, loamy fine sands, loamy very fine sands, sandy loams, loam	.6
5	Porous, Well Developed Structure in silt and silt loams	0.45
6	Other silt loams, silty clay loams clay loams	Unsuitable

¹ Very gravelly = >35% and <60% gravel and coarse fragments, by volume.

² Extremely gravelly = >60% gravel and coarse fragments, by volume.

Soil type 1A may be suitable if design of the absorption area meets the TRC Guidelines for Sand Filters (Reference 11), also see "engineering report", subheading #8, Type 1A soils.

Septic Tanks

A. Pre-cast

1. Pre-cast tanks shall be approved by DOH and meet the "Design and Construction Standards for On-site Wastewater System Tanks" (Reference 9).
2. Tanks in series are acceptable provided the first tank in the series contains no less than one day of detention time. Waivers to this requirement may be issued on a case by case basis by the review agency.

B. Poured in Place

1. Shall be designed by a licensed engineer for all structural loads and water table conditions.
2. The liquid level of two compartment tanks shall be designed at 1.5 times the daily maximum design flow. The compartmentation shall be 2/3 (first compartment, 1/3 (second compartment).

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3. All compartments shall have gas tight sealed access to finished grade. Minimum opening size for access shall be 18-inches and preferably 24-inches.
4. Shall meet the 1993 Washington State Department of Health "Design and Construction Standards for On-site Wastewater System Tanks"(note: until this document is finalized, please use standard engineering practice outlined in reference 2 and 10 or pre-cast tanks approved by the county health jurisdiction within the county the sewage system is installed. All other tanks shall be submitted with engineering documents and approved on a case by case installation.)

C. General Requirements

1. Maximum credited liquid depth shall be 6 feet and preferably 5 feet.
2. A minimum of 20 percent scum storage shall exist above the design liquid level.
3. Sanitary tees shall be used for inlet and outlet devices between compartments. PVC shall be used in lieu of cast iron.
4. The inlet and outlet sanitary tees of both compartments should extend below the liquid level a distance approximately equal to 40 percent of the liquid depth.

Pump Stations

- A. Pumps/electrical panels shall be sewage effluent rated and meet state electrical code requirements for installation and testing. Certification from the Washington State Department of Labor and Industries may be required.
- B. Each pump shall have an elapse time meter, dose counter to record pump running time. Elapse time meter and dose counter shall be located in the pump panel.
- C. Quick disconnect couplers or equivalent quick disconnect system shall required for all sewage pumps.
- D. Suitable non-corrosive screening or effluent filters shall be provided prior to the pump chamber for effluent pumps discharging to drainfield areas. Effluent screening acceptable to TRC guidelines and the review agency shall be installed on the outlet of all septic tanks.
- E. All pump chambers shall have access to finish grade for inspection and maintenance.
- F. All pump chambers shall meet the requirements outlined in "Design Standards for On-site Wastewater System Tanks" (Reference 9). Until this document is finalized, requirements contained in generally accepted design practice for wastewater pump stations (References 2 and 10) shall be used.

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Siphons

- A. Siphon chambers shall meet the DOH "Design and Construction Standards for On-site Wastewater System Tanks" (Reference 9). (Note: until this document is finalized, please follow requirements outlined in "F" above.)
- B. All siphon chambers shall have manhole or approved access over each siphon to finish grade.
- C. Each siphon shall have a dose counter or other approved device to measure flow and proper dose frequency.

Collection Systems/Piping

A. Gravity Sewers

Design and construction shall comply with the latest revision of "Criteria Sewage Works Design", Washington State, Department of Ecology.

B. Gravity Effluent Sewers

- 1. If the project is located within the Comprehensive Sewer Planning Area, design shall comply with "Gravity Sewers" item "A" above.
- 4. If outside a Comprehensive Sewer Planning Area, sewer sizing will be evaluated on a case by case basis using the most current technology available. It is recommended the effluent sewers be designed and sized as gravity sewers to facilitate future central sewer hook-up.

Monitoring Ports

- A. Shall be a minimum of four-inches in diameter and be located at representative points in the absorption area (see figure 1).
- B. Design and construction of monitoring ports shall conform to Figure 2.
- C. The intent of monitoring ports is to measure any anticipated liquid at critical depths within the trench or bed. A sufficient number of ports must be located in disposal fields to adequately assess operating conditions.

Fill Material

Fill Material Specifications

1.

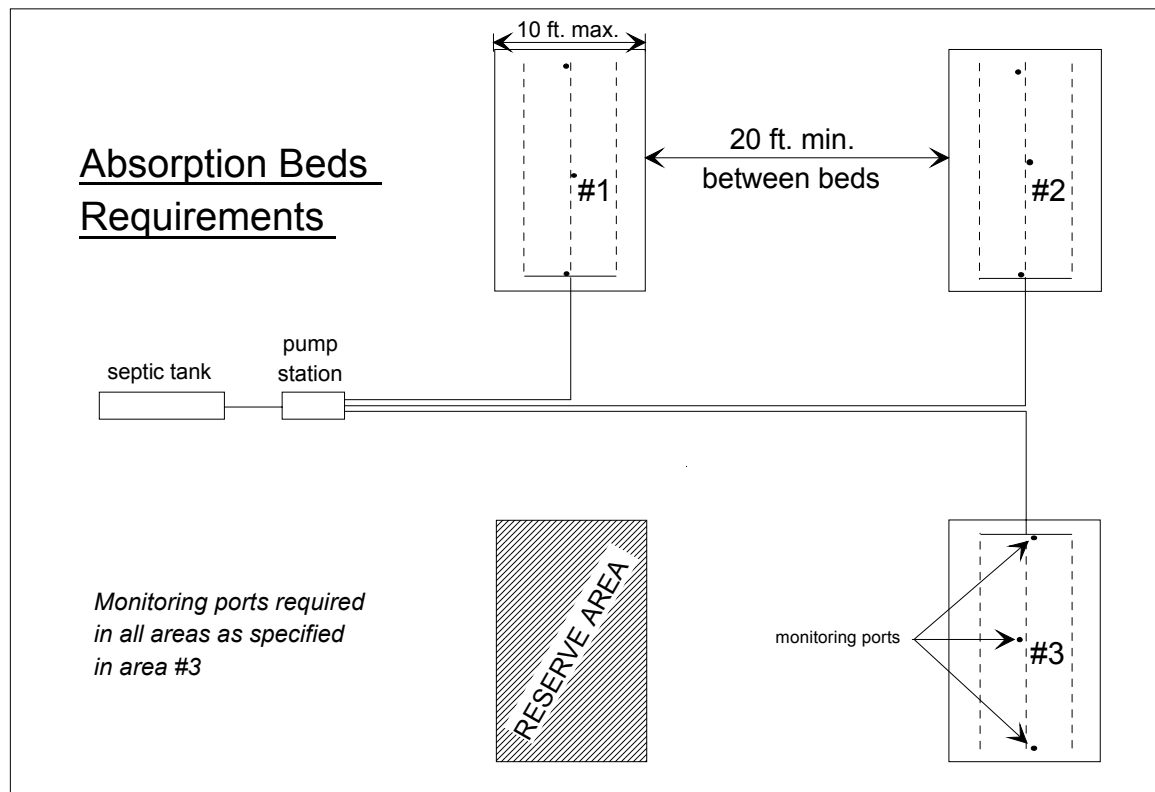
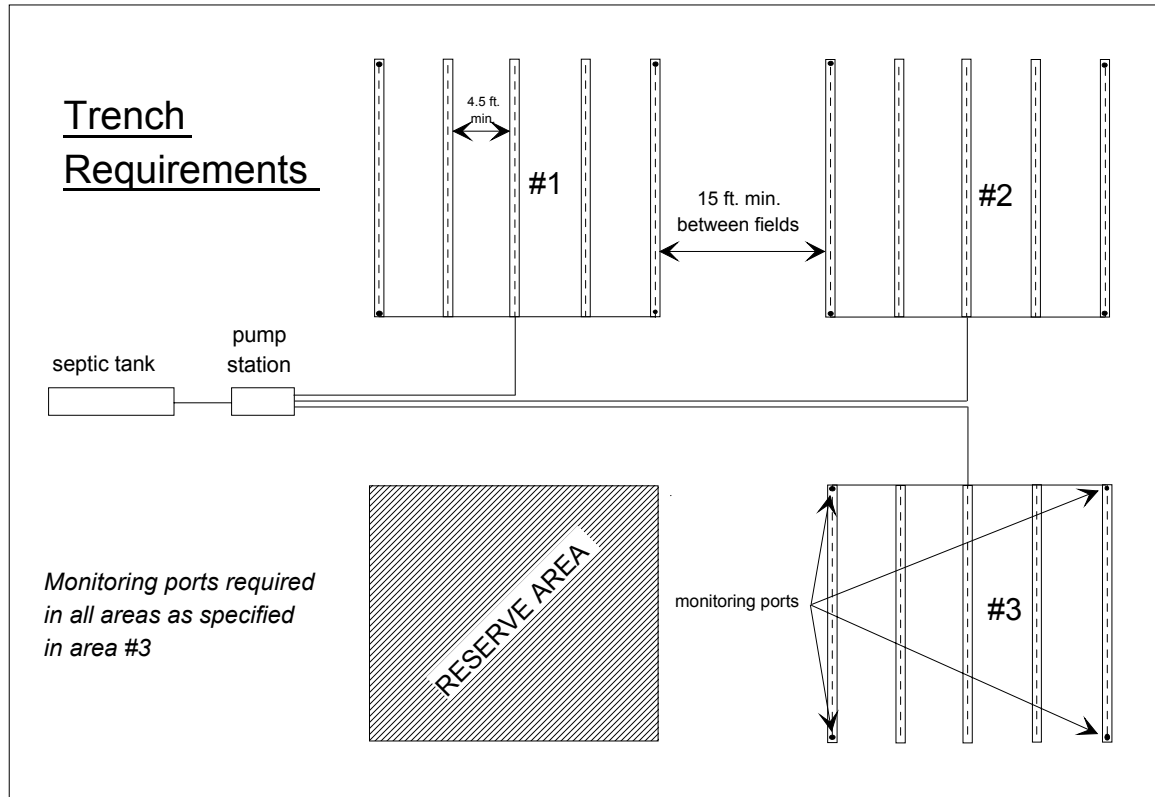
Sieve Size/#	Effective Particle Size	% Passing
3/8"	9.50 mm	100
4	4.75 mm	95-100
8	2.36 mm	80-100
16	1.18 mm	50-85
30	0.60 mm	25-60
50	0.30 mm	10-30
100	0.15 mm	2-10
200	0.075 mm	≤ 3%

Source: ASTM C-33, Specifications for Fine Aggregate

2. The sand shall have not more than 45% passing any one sieve and retained on next consecutive sieve of those shown above.
3. The FINENESS MODULES shall not be less than 2.3 nor more than 3.1. The Fineness Modules is defined as the SUM of the cumulative percentages retained in the sieve analysis, DIVIDED by 100, for the sieve sizes shown above (except for #200 sieve).
4. The limit for material that can pass the no. 200 sieve shall not be more than 3%.

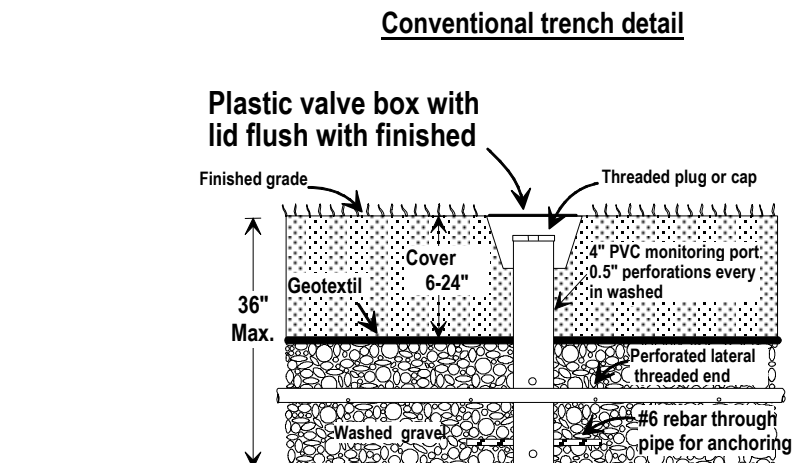
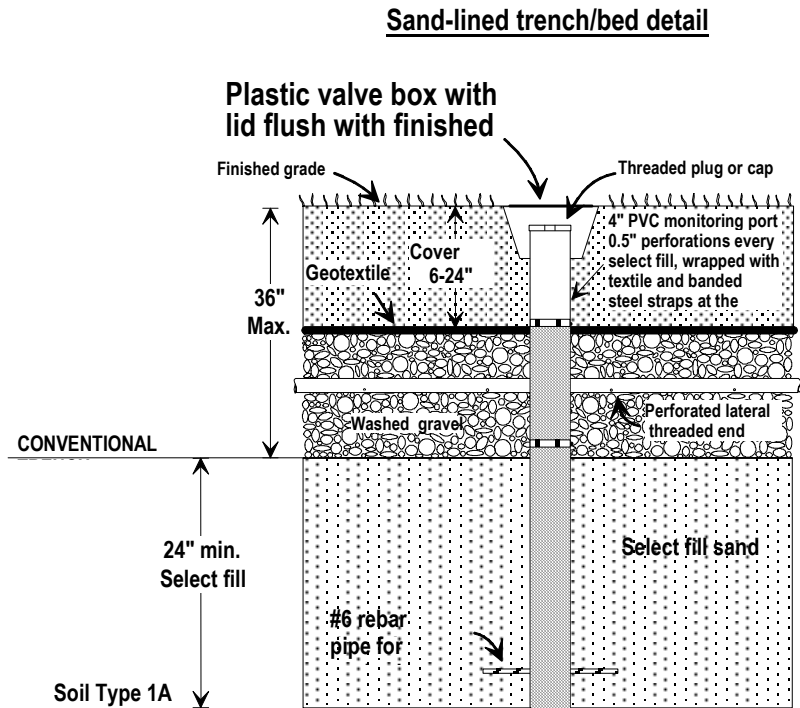
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Figure 1: Drainfield Area Requirements



Note: # 1, # 2, and # 3 each represent 50% of the drainfield area per Section 5 “Disposal Field Design Standards” Part C

Figure 2:
Monitoring Port Section
N.T.S.



**NOTE: Banded geotextile is optional on
but is required on Soil Type 1A sand-lined**

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Section 6

References

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